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To assess public response to five science programs shown on National Educational Television, questionnaires were sent to selected high school and university science teachers, and two programs were shown in private screenings to sample groups of adults and students. Responses to the questionnaires showed that a large majority of those answering had a favorable impression of the scientific presentation of the programs, but focussed concern on the ability of the lay public to understand the scientific material involved. In the private screenings, because there were no experimental tests to determine learning systematically, all learning over chance was taken to be significant, and on this criterion the films were felt to produce significant information gain by the viewers. It was felt by all groups that the science programs encouraged and maintained interest in science. (BB)

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SCIENCE PROGRAMMING

AND THE

AUDIENCES FOR PUBLIC TELEVISION

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SCIENCE PROGRAMMING AND THE AUDIENCES FOR PUBLIC TELEVISION

An Evaluation

Of Five Programs in the

NET "SPECTRUM" Series

Questionnaires returned by science teachers across the country and reaction forms completed by selected high school, college, and adult learners, were analyzed to judge the impact on and acceptance by public television audiences, of five half-hour programs broadcast in the "Spectrum" science series, produced with financial support from the National Science Foundation. A general significant knowledge gain was achieved by high school, college, and adult learners; learners and science teachers surveyed reported a satisfaction that science programs should be broadcast for the general public and that in addition to gaining a high rate of acceptance by laymen, the programs encouraged and maintained interest in science.

INVESTIGATOR'S NOTE

The NET Educational Services Department is greatly indebted to those whose cooperation made possible the completion of this investigation. Our principal consultant for the field work, the questionnaires and their administration, was Peter C. Benedict, associate professor of geology at the State University of New York at Albany; for the report itself it was Stephen C. Johnson, lecturer in the School of Education and program supervisor, Field Services Department, Audio-Visual Center at Indiana University. Milton R. Stern, director of the University Center for Adult Education at Detroit and Daniel Woodard, vice principal at White Plains High School, White Plains, New York, made possible the administration of tests at their respective institutions. Raymond P. Zelazny, coordinator of course programs, conducted and reported the research at the University Center. The tests at White Plains High School were administered by science teachers C.D. Heath (biology) and S.C. Tamboia (earth science). Miss Nancy Freitag conducted a special test group with graduate students of education at the University of Michigan. Miss Bobbi Jaison assisted in the tabulation of questionnaire responses.

The NET Science staff gave their full cooperation; David Prowitt, science editor, and producers Robert Dierbeck, Bert Shapiro, and Eliot Tozer helped not only as authors of study guide copy but also in advising on questions to be asked in various questionnaires and in analyzing replies.

Henry C. Alter
Director
Educational Services, NET

Summer, 1969

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INTRODUCTION

This report is an evaluation of the impact and acceptance of five programs produced with financial support from the National Science Foundation and broadcast in April and May, 1969, by National Educational Television* as part of the continuing weekly science series, "Spectrum."

The Programs

1. Exploring the Universe--In Radio and Light (April 30)**

   New developments in radio astronomy and optical astronomy to further understanding of the nature of stars, galaxies, quasars, and past and present of the universe itself.

2. Changing the Weather (May 7)

   Recent research in meteorology, focusing on the problems and methodology of altering storms and controling climate.

3. The Trembling Earth (May 14)

   Current issues in seismology to discover the structure of the earth and major geological processes in predicting earthquakes.

4. Stop or Go--An Experiment in Genetics (May 21)

   Experiments in understanding the factors which govern heredity, chemical language, and pursuing the ability to alter genetic formulas.

5. A Visit with Harold Urey (May 28)

The Nobel-Prize-Winner, chemist, physicist, creative thinker, and teacher discusses the major influences on his life and the conclusions he has reached about science and our world.

Originally, these programs were not broadcast in sequence. Two of them were aired late in 1967, two early in 1968, and one in the spring of 1969. In order to make possible the evaluation reported here, the NET program department arranged to have the first four programs repeated at weekly intervals, following the premiere of the latest one.

**The dates (Wednesdays) listed are those of the network "feed" at 8:00 p.m., E.D.T., but, as is customary, individual stations retained the option to air the programs at those times or to tape them for broadcast at a later time. Many stations also scheduled a repeat broadcast within a few days. We can assume with confidence that virtually all the NET affiliates did air the five programs at some time during the week of the network feed.

Method of Investigation

As outlined in the original NET proposal to the National Science Foundation, the evaluation was planned in two major phases: (1) a mail questionnaire (see Appendix A), addressed to teachers of high school and college science, elicited responses based on viewing the programs broadcast on television; (2) selected college, high school and adult learners were shown the films in small groups and were asked to complete a different reaction form at that time.

The mail questionnaire provided reactions to each of the five programs, while the film screenings with learners were limited to two programs (this was necessary because of the relatively time-consuming task of obtaining prints, shipping them to different locations, and using instructional time to obtain feedback). Two films were selected for projection to represent opposite poles in terms of ease or difficulty of the subject matter. The overall mail responses indicate conclusively that, had it been possible to project and test student reaction to the other three programs, responses to them would have fallen somewhere between the responses obtained on the two programs selected.

Phase I: Questionnaire for Broadcast Viewers

In the first three months of 1969, mailing lists were obtained from two sources to mail questionnaires to science teachers at secondary schools and at colleges and universities.

From the National Registry, National Science Teachers Association, NEA:

	10,000	biology teachers, high school faculty
	10,000	earth science teachers, high school faculty
	10,000	heads of science departments, high school faculty
TOTAL:	30,000	high school teachers of science

From the Educational Directory of Marion, Ohio:

	3,230	biologists, college and university faculty
	2,682	geologists and meteorologists, college and university faculty
	802	astronomers, college and university faculty
TOTAL:	6,714	college and university teachers of science
GRAND TOTAL:	36,714	high school, college, and university teachers of science

Each mailing included a questionnaire, one or two study guides which corresponded to the addressee's field of specialization (see Appendix B) and a postage-paid reply envelope, coded to the mailing list used. The mailing was timed to reach most recipients two weeks to ten days prior to the first scheduled broadcast.

Phase II: Evaluation for Learners in Test Groups

(The College Sample of 150 students in 6 groups)

Late in 1968 Peter C. Benedict, Associate Professor of Geology on the Albany campus of the State University of New York (SUNYA) was asked to read the study guides and to screen the films, in order to design instruments of evaluation. Professor Benedict also agreed to conduct some of the evaluations with his students and arrange for others to be conducted by a colleague on the SUNYA faculty.

(The Adult Sample of 160 adults in 8 groups)

Shortly thereafter, arrangements were made with Milton Stern, Director of the University Center for Adult Education in downtown Detroit to conduct similar tests with several groups of adults enrolled in various courses conducted by the Center.

(The High School Sample of 195 students in 16 groups)

Also, agreement was obtained from Daniel Woodard, Vice Principal at White Plains High School, White Plains, New York, to conduct the tests with groups of high school students there.

The group screening and testing phase began in February and ended in May, 1969.

RESULTS

The portion of the report which follows falls logically into two main sections, one on the mail questionnaire, and one on the test groups, followed by some general conclusions.

The findings and conclusions reported here may be supplemented and refined through subsequent research and replication. The raw data contained in nearly 1,000 test papers and questionnaires obviously number in the tens of thousands and may be analyzed in many ways. It is our intention to make them available to an educational researcher at the Indiana University Audio Visual Center who is working in the area of the evaluation of messages in educational materials. We hope that his work will develop important additional dimensions, as it is integrated with the current state of the art in "product evaluation."

I. Results: The Mail Questionnaire

This phase of the evaluation was clearly the more innovative of the two procedures, for several reasons. First, it was geared entirely to television, viewed at home, largely outside of school hours. Second, although addressed to professionals, it was designed to gauge the program's relevance to laymen. Third, without offering an inducement other than an offer of additional study guides, it asked for a greater effort on the part of the respondent than most surveys: the respondents were required to ascertain the actual local air time for the program they were to see, they had to keep that time in mind for a period ranging from ten days to several weeks, make the effort and take the time to view one or more of the half-hour programs, and then communicate their reactions to the investigator.

In order that this task not appear overly formidable, it was decided to ask each respondent to review just one, or at the most two, of the programs closest to their indicated field of specialization. Accordingly, most of the biologists received only the study guide for the genetics film, the geologists received the seismology guide and the meteorology guide or just one of the two, the astronomers were sent both the radio astronomy guide and the one on the Harold Urey interview, and the science department heads received the Harold Urey guide and any one of the other four.

It should be noted in this connection that 42% of the respondents took the trouble to request one or more of the guides that had not been sent to them originally--clearly an indication of the usefulness of concomitant materials to aid study.

Overall Responses to Questionnaires

As indicated above, a total of 36,714 names and addresses were used in mailing the questionnaires. Normal attrition, through spoileage of labels and envelopes, brought this total down to 34,986 pieces actually mailed. Direct mail specialists estimate that roughly 10% of a mailing of this size is undeliverable due to address changes, deaths, loss, and other causes. On that basis it can be assumed that between 31,000 and 31,500 persons actually received the mailing.

Since most of the mailing lists were national in scope (only one of the three NEA lists was limited to six "Major markets,") it must be assumed that a certain number of questionnaires were received in areas not yet served by public television. An estimated 20% of television households in the nation are not served by public television stations, but that figure cannot be used because 65 responses were received from persons who returned the questionnaire with the comment that their area is not yet served by public television, many of them adding urgently worded remarks regretting their exclusion, or exhorting NET to extend its coverage. Despite this, it is fair to assume that an unspecified number of questionnaires, received in non-public television areas, were ignored for that reason. These must be added to other factors, such as the time and effort required for a meaningful response, and the local variations in air date and hour, in gauging the size of the response and its significance. It should be noted that the response to our mail questionnaire may have suffered in some locations because we were not able to inform all recipients of the exact day and hour they could view the program locally.

Altogether, 420 responses to the questionnaire were received. This is between one and two percent, considered an acceptable rate of return from any sample as free from organizational ties to the agency originating the survey as were these teachers, and lacking any tangible benefit. Moreover, some of the respondents, on their own initiative, asked their classes to view the programs and reported a substantial number of reactions, rather than just one response. Some teachers went even further, asking their students to write reports on the program they had viewed, and submitting these. Some of these student papers are in Appendix E.

Some aspects of this investigation--among them the unsolicited student papers--must be viewed as a bonus. Other aspects which might have been anticipated but were not, made precise tabulation more difficult. Among these was the factor that many teachers returned the questionnaire, but did not use the coded reply envelopes, while others used the envelope to return a letter of their own but no questionnaire, and still others wrote letters without using either the questionnaire or the envelope, Finally, some useable responses were received from persons who could not see the program, but wished to comment on the study guides, or on some relevant aspect of public television. An attempt has been made to report all relevant information, despite the fact that these findings will not be easily categorized and that some totals, obviously, will add up to more, and some to less, than 100%.

Table 1: Overall Reaction to all 5 Programs: *

Favorable	143	57%
Mixed**	72	29%
Unfavorable	35	14%

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*See also the "Selected Comments" on each program, Appendix C

**In most cases, respondents actually listed several specifics each under "strong points" and "weaknesses"

Effectiveness of Mail Survey

The most obvious statement that can be made here is that college and university instructors responded in far greater relative numbers than did high school teachers. Numbering only 5,618, or 16% of our total mail count, they returned 127 coded replies out of 342, or 37% of the response. This is further increased by the fact that the great majority of those using their own envelopes instead of ours were college or university instructors.

There may be significance in these figures beyond the scope of this report, apparently supported by other findings about the audiences of public television. Virtually all previous studies of that audience have agreed on one point: the more education one has, the more likely he is to be a regular viewer of public television. It is not unreasonable to suppose that, among those receiving our mailing, the ones most likely to respond were the more highly educated, and therefore, regular viewers.

The rate of response to all three of the high school teacher lists was below 1% while it was between 2% and 3% for the college and university lists. The smallest of these lists, 788 astronomers, produced the highest return in the sample, but this may have been due to the fact that the radio astronomy film was the first program broadcast in the series, and the only one not broadcast previously. On the other hand, the largest number of response was received for the genetics film (shown fourth) the second largest for radio astronomy (first in the

series) followed by seismology and weather. The smallest response was that of the Harold Urey program, but this may be explained by the timing of the broadcast immediately prior to the Memorial Day holiday.

Analysis of the Responses to Individual Questions on the Mail Questionnaire

1. Date of Broadcast: This question was included as a check on the stations' scheduling of these programs. An analysis of the dates given shows that fully one-third of the respondents saw the programs at a time other than the network feed, and about half of these with a one-day delay, when the Eastern Educational Network of more than 25 stations carried them. A number of Western stations apparently aired "Spectrum" on Sunday, four days after the network release, and there was a sprinkling of still other dates as well. Some respondents were vague as to the exact date, and a small number appeared to respond on the basis of the original 1967/68 airing of four of the programs.

2. City in or near which broadcast was seen: The geographic spread of the survey was comprehensive with responses from 44 states and the District of Columbia. (There is no public television coverage in three of the six states not responding.)

3. Is it possible that you might have viewed this program if you had not received this notice? This question, designed to show whether the respondents were aware of public television, was answered as follows:

yes: 60% no: 40%

It is worth noting here that, when an almost identical question was asked of the various test groups, the answers were:

	yes:	no:
High School Sample	37%	63%
College Sample	32%	68%
Adult Sample	77%	23%

While this indicates a tremendous bias in favor of public television on the part of the adult sample, it is not inconceivable that persons who voluntarily take adult education courses, most of them non-credit, would also be the most likely group to view public television regularly, and be favorably disposed toward it. It is also consistent with what is known about the viewing habits of young people that students answered as they did. Both student groups (high school and college) were unlikely to have viewed these programs as they were broadcast. High school students, generally living at home, had a slightly better chance to have seen them than did college students, a segment of the public which is known to see little or nc television of any kind.

4. Do you feel that this program presented information about science that the general public should have? Overwhelmingly, this question was answered in the affirmative. The only negative responses came from those who felt that the particular subject matter was too complicated in its substance or presentation to be understood by the general public. Since the following question deals more specifically with comprehension, we had hoped by this question to learn whether teachers in general feel that scientific information should be made widely available, or whether it should remain the province of the expert. Clearly, they favor broad dissemination of scientific knowledge to the general public.

5. Was the information presented so as to benefit a lay person? In some respects, this was the central question for the entire survey, and the real answers to it must be sought throughout the written comments (see Appendix C) and in the letters. Expressed in figures, the answers were:

Table 2: Presentation Suitable to Lay Public:

	Entirely:	In Part:	Not at All:
Universe	15	36	1
Weather	17	22	0
Trembling Earth	17	20	0
Genetics	15	71	6
Urey	7	8	0
	71	157	7

6. Please comment briefly as to strong points and/or weaknesses in the presentation: Representative samples of replies are quoted in Appendix C. They speak for themselves, and dramatize the delicate balance, which the kind of program being evaluated must seek, between a body of knowledge that is vast, specific, and demanding and a method of presentation that must appeal to varied interests and motivations. The following table represents an attempt to summarize the reactions of all respondents to each of the programs inasmuch as the evaluation quotations in Appendix C do not reflect the actual distribution of positive, negative, and mixed responses.

Table 3: Response to Individual Programs:

Title	Favorable	Mixed	Unfavorable	Total
Universe	29	13	10	52
Weather	23	13	4	40
Trembling Earth	28	8	3	39
Genetics	51	35	15	101
Urey	12	3	3	18
	143	72	35	250

In additon to the comments in Appendix C Appendix E includes some letters and student papers of special interest. (Included, as a tribute to the effectiveness of the mailing list, is a spirited letter from the renowned seismologist Charles F. Richter of the California Institute of Technology.)

Analysis of Comments

It is hoped that the comments (in Appendix C) convey the range of reaction received from the sample of professionals. Many seem to focus on whether or not the programs could be understood by the lay viewer. A comfortable majority of individual statements, supported by the weight of the answer given to question 5, ("Was the information presented so as to benefit a lay person?") seem to indicate a positive result. It appears that, except for more diagrams and animated sequences, the producers could not have done a great deal to make these subjects more accessible without compromising the substance that had to be transmitted.

In addition, there is evidence that even the more difficult programs were reasonably well understood by 10th grade students and some 8th graders, viewing on television at home rather than in the classroom. In fact, it does not appear from this survey that those who viewed the films projected in the classroom were significantly better able to understand them than were the viewers of television. The kinds of detail, both on content and on production values, that were observed by television viewers, indicate that the medium is fully capable of conveying the information required by these subjects.

7. In your opinion, could the broadcast have the effect of encouraging young people to seek careers in science? Consistent with earlier expressions of approval, this question was answered as follows:

yes: 188 no: 34

Here it is appropriate to quote the answers given by some tenth graders in an honors section in BSCS(green version) Biology:

"Yes, the overall protrayal seemed honest."
"Yes, unless they hadn't planned on as much work."
"Yes."
"Possibly, if they had a sincere interest in science."
"It could."
"To some degree."
"Yes. Programs such as this tend to spark one's curiosity."

These comments were made about the program "Stop or Go," clearly the one found most difficult by all of the adults, teachers and laymen alike. (See section II, the Test Groups.)

8 & 9. (Optional space for name, address, and request for additional study guides.) As reported, 42% of all respondents did ask for additional study guides. Some, indeed, went beyond the offer we had made and asked for large numbers of guides for one or several classes. Some of these requests were met at the outset, but it was found necessary later to enclose a note explaining that requests had to be limited to a single copy.

As expected, most of the requests for guides came early in the five program series, dropping off toward the end. One kind of response occurred frequently in the beginning--a request for additional guides and questionnaires in order to send in evaluations of subsequent programs. The investigator responded to these requests, using a special code on the return envelopes, but was disappointed to find that they were returned in only one case. Perhaps, in the final weeks of the school year, teachers found it impossible to carry out their earlier good intentions.

II. Results: Learners in Test Groups

The test groups included three samples:

The College Sample of 150 students in 6 groups
The High School Sample of 195 students in 16 groups
The Adult Sample of 160 adults in 8 groups

In general, the procedure was the same for all the test groups. The films were projected and the questionnaires handed out and completed during a regular session of the class or group being tested. Except where the instructor himself administered the test, advance permission was obtained from the regular instructor and the person conducting the test did so as a guest of the instructor. In Detroit, the adult students were given advance notice of the film showings and the test. All of the groups understood clearly that their participation was regarded as a courtesy to NET and that their scores on the tests would have no significance whatever in terms of their standings in the regular course they were taking.

Number and Composition of Test Groups

The College Sample (SUNY, Albany)

Geology 105	21 students	Genetics
Geology 105	22 students	Trembling Earth
Science 112	31 students	Trembling Earth
Science 113	44 students	Genetics
Earth Science 202	16 students	Trembling Earth
Earth Science 202	16 students	Genetics
	150 college students	

Students in Geology 105 are freshmen who may major in science; Science 112 and 113 are service courses taught for non-science majors; Earth Science 202 has an enrollment of juniors and seniors majoring in the sciences.

The High School Sample (White Plains H.S., N.Y.)

10 Biology Lab Sections (Juniors and Seniors)	105 Students	Genetics
6 Earth Science Classes (Juniors and Seniors)	90 "	The Trembling Earth

The Adult Sample (University Center for Adult Education, Detroit)

Fundamentals of Film Production (Credit Students)	15 Students . .	The Trembling Earth
Fundamentals of Film Production (Credit Students)	11 "	Genetics
Contemporary Thought and Writing (Housewives).	26 " . .	The Trembling Earth
Contemporary Thought and Writing (Housewives).	27 "	Genetics
Basic Writing Class (ATTAC, Poverty Program).	.15 " . .	The Trembling Earth
Beyond 60: Sounds of Silence (Senior Citizens)	20 " . .	The Trembling Earth
Writing and Language (Saturday Class)	32 " . .	The Trembling Earth
Graduate Students in Education (Univ. of Mich.) . . .	14 " . .	The Trembling Earth
total	160 Adults	

Grand Total 505 Subjects in all samples

Analysis of Reaction Forms--College Sample and High School Sample

All of the test groups operated under the necessary handicap of the paper-and-pencil instrument and the "testing situation" associated with it. The results obtained should not, however, be interpreted in the same way as test papers used in class instruction. The "passing grade" obtained in the usual students' tests signifies responses to a complex, purposeful process which a single television program (film) cannot be expected to replicate. Instead, when one considers the conditions under which most viewing of television takes place, it seems more appropriate to assume that, because of the technical nature of the information, knowledge was at a zero level before viewing the film. In that case, anything above chance response indicates knowledge gain which is logically significant, even where it is not statistically significant. This factor is underlined when one considers the probable numbers of persons viewing these films on television--likely in excess of one million for each film.

With populations of that size, even the most random learning represents significant information transfer, and the evidence indicates that the learning which took place was far more than random.

To measure the learning effectiveness of the films, a simple scoring system was used, in which one point was awarded for giving a really relevant answer, one half point for showing some understanding or giving a partially correct answer, and zero for giving a wholly incorrect answer or no answer. *

*For the "Trembling Earth" reaction form, see Appendix D; for the "Stop or Go" reaction form, see Appendix F.

With one exception, the test groups achieved better scores on "The Trembling Earth" than on "Stop or Go," probably because the former was both easier to understand and provided more opportunities for emotional identification. Throughout all the groups, surprises were at a minimum, with higher scores being achieved by more advanced students (and, among the adult sample, by persons with more schooling).

It is a matter for speculation whether scores could have been significantly improved by the inclusion of more diagrams (desired by many respondents to the mail questionnaire,) or by having the film provide a summary or "wrap-up" feature which students have come to expect in the more didactic films produced for classroom use. Whether or not this is the case, the requirements of television presentation had to govern the format used, calling for a non-didactic approach.

In the context of television presentation, special attention needs to be paid to the "opinion" questions on the reaction form, and their possible relation to knowledge gain as seen by the viewer in the light of his original interest and the loss, maintenance, or increase thereof before and after viewing.

Thus it is possible to compare the answers to Question 1, which asked if the respondents would have viewed the film on their own at home, and Question 3, which asked if the film had held the viewer's interest.

The following table traces this dimension for a sample of the high school students for each of the two films.

Table 4: Original Interest and After-viewing Interest
(White Plains High School)

Question 1	Question 3	Percentage of Sample	
		Seismology	Genetics
No	Yes	48%	38%
Yes	Yes	32%	22%
Yes	No	10%	2%
No	No	10%	38%

It is clear that the seismology film fared better with this sample than did the genetics film. Distortion and bias are evident in the number of students who said (after viewing,) that they would, or would not, have watched the film on their own. For the more "successful" film, 58% said they would not; for the less successful, 76% said the same. They were projecting their lack of approval into their estimate, although it might be argued as well that more young people would be inclined to view a television program on earthquakes than one on genes.

However, the more encouraging evidence seems to be that whatever the estimate of original interest, majorities of both groups said that the films did hold their interest when they saw them: 80% said so for seismology, 60% for genetics. The combination expressing the most disappointment--those with original interest who lost it when viewing the film--is so low in both cases that it is probably without statistical significance.

In a cross section of the college sample, where higher motivation may be inferred, the two dimensions of Yes/No and No/No did not show up at all for the seismology film, and Question 3 got an almost unanimous Yes

answer. By contrast, the genetics film ran into the same bias described for the high school sample--two thirds answering No to Question 1, and the after-viewing approval was down from 100% to 75%.

Achievement with respect to the content questions appears consistent with the foregoing observations. Reaction forms were graded and a Mean Score used throughout the samples. Correct and relevant answers to each question would result in a score of 100.

Table 5: Mean Scores Achieved in Test Groups
(High School and College Sample)

	Seismology	Genetics
High School Sample (N:47)	44%	
High School Sample (N:39)		36%
College Sample		
(Freshmen, General Science; N:31)	42%	
College Sample (Freshmen, Geology; N:22)	54%	
College Sample		
(Juniors and Seniors, Geology; N:16)		77%

Instructors have reported that, except for the college juniors and seniors, none of the students had had instruction paralleling the content of either film. They were, in fact, thought to be representative of the average viewer of public television in educational attainment, if not in age. The college seniors scoring 77% on the genetics film, even though their major was geology, represent a group of advanced science students who were easily able to handle a subject outside their major field, an indication of the perimeters of utility of this particular film.

The significance of these scores, as expressed by one consultant, is that "...if the viewers of these films are able, on the average, to show an understanding of about half of the many points discussed, then the film must have been effective. Also, if the film maintains the interest of people who would not have tuned their sets to it on their own, this shows what impact it could have on the general public, if they could be persuaded to view it." The same consultant points out that "... in the time of one half hour a significant increase in knowledge about a highly complex subject was effected."

Analysis of Reaction Forms--Adult Sample

Because of its greater relevance to this survey, the adult sample will be discussed in more detail than the other two samples.

When the report on the Detroit adult test groups was submitted*, the covering letter had this to say about "Stop or Go":

> "I did take the genetics film and show it to two groups after which point I decided to discontinue showing it. The response of the first two groups was very hostile and negative, and I felt I would be taking unfair advantage of the respondents if I continued showing the film. I do have 38 completed questionnaires which you may have."

This confirmed once again that few people are indifferent about this film--they either like it a lot, or they hate it. The investigator felt that the Center was right not to persist in further screenings, and decided to summarize the extant questionnaires. These findings will be reported following the data on the completed tests with "The Trembling Earth." Meanwhile, it should be kept in mind that "Stop or Go" yielded twice as many mail questionnaires as any other program, and that college juniors and seniors scored very high in the test following their screening.

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* With minor alterations, this is the report prepared by Mr. Raymond Zelazny of the University Center for Adult Education. The changes made are designed to incorporate data on three groups omitted in the report: two at the University Center who viewed "Stop or Go," and one group of graduate students at the University of Michigan who viewed "The Trembling Earth."

NET requested the University Center for Adult Education to survey at least 100 adult education students. The questionnaire prepared by NET was used by all the students in the survey. A cross section of adult education courses was selected to roughly represent students who typically participate in various UCAE activities. The sample was selected by type of participant--university credit students, poverty program trainees, senior citizens, housewives, workshop and general instruction students. These people are presumed to represent a cross section of the adult community based upon UCAE experience. Their enrollment in a formal program of instruction is assumed to suggest a favorable disposition toward education.

The instructor of each group was asked for permission to conduct the project with his students. Those instructors who agreed were asked to announce the project to their class the session before it was to be conducted. The survey was conducted during the regularly scheduled class period. Attendance was reported as normal for all groups. The group was given the following information: (1) the purpose, sponsors and general conduct of the study; (2) two kinds of questions appearing on the questionnaire were explained as follows: a) questions 1 through 6 were to reflect expressions of viewers opinion; and b) questions 7 through 19 were questions about the film's content. The half-hour film was then shown. Questionnaires were distributed, completed and returned. This procedure averaged about 15 minutes.

In the tabulation (see appendix D) opinion questions were separated from

content questions. Various comments about the film's interest are charted separately and appear in Table I of appendix D. The content questions were scored on the basis of one point for a correct answer; $\frac{1}{2}$ point for a partially but correctly answered question, or an answer which was partially incorrect; and no points for a blank or an incorrect answer. Table I of appendix D contains responses to the opinion questions and answers to the content questions. Correct answers to content questions were determined from the film and from a study guide provided by National Educational Television. A tabulation of the scores is contained in the summary of each group--Tables II-VI of appendix D respectively. Tables II-VI reflect each group's response and performance.

Analysis of Responses to Individual Questions on the Reaction Form
(Adult Sample)

"The Trembling Earth"

Opinion Questions 1 - 6

Question 1. Would you have watched "The Trembling Earth" on TV at home, if you had known about such a broadcast?

90 - yes 17 - no

Eighty-four percent (84%) of the respondents indicated that they would watch the program. *)

See Master Tabulation, appendix D

Question 2. Do you feel that enough explanations of terms and processes were offered in the film?

78 - yes 30 - no

Seventy-two percent (72%) of the respondents felt that the film provided enough explanation of terms and processes.

See Master Tabulation, appendix D

Question 3. Did the film hold your interest? (Please explain briefly why it did, or did not.)

99 - yes 15 - no

Adult education students indicated a general interest in the earthquake film. The students indicated that their interest in the film was held primarily by the use of vivid illustration, a current events topic, and a well organized presentation.

See Table VII, appendix D

Question 4. In your opinion, which of the groups listed below would benefit most from seeing this film? (Geologists, Scientists other than geologists, The general public, Persons who might choose geology as a career, People who live in an earthquake-prone area.

169 - Non-science 49 - Science

See Master Tabulation, appendix D

* When the two groups viewing "Stop or Go" are included, the response drops to: yes: 77% No: 23%

Question 5. Do you feel you gained some knowledge about: a) the behavior of the earth's crust; b) the interior of the earth; c) the way scientific information is gathered; d) the way it is evaulated, e) the nature of waves.

The film offered a general knowledge gain. The gain was most prominently reflected in "the behavior of the earth's crust" and "the way scientific information is gathered."

See Master Tabulation, appendix D

Question 6. Did you know what a seismograph is before you saw this film?

74 - yes 34 - no

Sixty-eight and four tenths percent (68.4%) of the respondents indicated that they knew what a seismograph was before the film was shown.

See Master Tabulation, appendix D

Content Questions 7 - 19

Question 7. If you did not know, do you know now what it is?

20 - yes 14 - no

Of the 34 respondents who answered no to Question 6 20 answered yes to Question 7. This should reflect an information point gain in Question 8 and 9.
(Possible 40 points.)

The highest possible score for Questions 8 - 19 was 12. The respondents produced mean scores as follows: (To the nearest tenth) College students 7.3; general course and workshop students 5.1; housewives 3.5; lower socio-economic group 2.5; senior citizens 2.4. The overall group mean was 4.16.

Most adult education students (84%) would have watched the program at home on television if they had known about such a broadcast. The vivid illustrations, well organized presentation and current news and values which held the viewers' interest. Terms and processes were adequately

explained for most of the respondents (72%), but these explanations were not translated into answers to content questions as reflected by the total mean score (4.16 out of a possible 12). The respondents indicated that the film would benefit the non-scientist more than the scientist (more than 3:1). The film provided most information about the behavior of the earth's crust (4:1) and the way scientific information is gathered (7:1). Although many respondents (60%) indicated that they had a specific information gain (Question 7) they were unable to translate that gain into written answers to specific questions about the information (Questions 8-9).

One of the problems with an evaluation such as this is that non-credit students are generally not accustomed to taking tests whereas the credit student is. This suggests a pre-disposition toward the pencil-paper instrument provided by NET which would favor the group accustomed to tests.

The scores from the content portion of this survey bear out the contention by showing a substantially higher average score (7 1/3) by the credit group. Also, the specific information gain question (7) indicates that the one individual who did not know what a seismograph was before the film knew what it was after. This was demonstrated by the information gain point increase of two out of a possible two.

The opinion expressed in Question 2 was that an adequate explanation of the terms and processes was offered. This is contradicted by the respondents' inability to record answers about the film's content as evidenced by the mean score of 4.16 out of a possible 12. Based upon the instructor's

experience and assessment of the film, it was predicted that the final rank order of the groups would be credit students, housewives, general audience, senior citizens and poverty program people. The post-survey outcome ranking conformed closely: credit students, general audience, housewives, poverty program people, senior citizens.* A radical change in this ranking or a closer grouping of scores might indicate a greater effect on learning due to the film.

Table 6: Mean Scores Achieved in Test Groups
(Adult Sample)

	Seismology	Genetics
Credit Students (Film Production; N:15)	60%	
Graduate Students (Education, UofM; N:14)*	59%	
Writing and Language (N:32)	42%	
Credit Students (Film Production; N:11)		36%
Housewives (N:26)	29%	
Poverty Program (N:15)	21%	
Senior Citizens (N:20)	20%	

As reported by Mr. Zelazny, these groups somehow could not come to grips with the genetics film. The group for which a score was obtained (Credit Students,) actually did far better even with this film than some of the educationally disadvantaged groups did with the easier film, although its own score dropped by 24%. Yet, when compared to reaction forms the same individuals had completed for the seismology film, these forms expressed frustration, even irritation. This was even more marked for the only other group that was shown the genetics film, the housewives. In both groups, the handwriting appeared more careless, and comments such as "too scientific and technical," "too deep," abounded.

* The graduate students' group was not part of Mr. Zelazny's assignment.

The two groups viewing both films also showed marked variations in the opinion questions. Their combined answers to Question 1, (prior interest,) were: Seismology--Yes: 32, No: 8. Genetics--Yes: 20, No: 18. For Question 3, (interest maintained,) the answers were: Seismology--Yes: 38, No: 3. Genetics: Yes: 16, No: 20. This represents the single instance in the survey where a majority reported that a film had not held their interest.

In general, the scores obtained in the adult sample are far from disappointing. Some were actually higher than those of the student samples, while those that were lower came from groups of persons whose education was deficient. In addition, the adults as a group are, of course, far less accustomed to the testing situation than are the students.

CONCLUSIONS AND DISCUSSION

It is evident that the five science programs broadcast by NET reached a high level of acceptability and information transfer.

Both learners and professionals indicated that their attitudes toward the content and treatment of the various science topics were essentially positive, and were enhanced or maintained throughout the presentation.

One problem with this kind of evaluation is the relative lack of precision concerning "instructional" goals. When educational films are evaluated for curricular integration, instructional utility is measured against precise specifications, keyed to specific objectives and courses of instruction. In public television programming the problem is quite different. Not only is there no particular teaching objective or audience established, but the motivation of viewers may vary from a highly specific, active, professional interest in the subject to an "entertain me, if you can" passivity.

In some respects the five programs, along with most others in the "Spectrum" series, tried to do two things considered by some educators to be opposite: we want to teach and we want to "entertain," both in an environment we do not control, and in which it is up to the individual viewer whether he chooses to be taught, to be entertained, or neither. This presents the television producer with a challenge and an opportunity. The challenge is to live up to reasonable professional standards; the opportunity is to appeal to large numbers of persons with the hope of awakening an interest in science.

Even so, the question remains whether the film should, for example, increase by 10 percent the knowledge of a viewer already familiar with the subject matter, or by 50 percent the knowledge of one never before exposed to it. This research seems to indicate that we were able to appeal to both kinds of viewers, well informed and uninitiated, but that these results varied strongly from one film to another.

Our approach to this evaluation has been eclectic; there are few precedents to guide us. Even in the seemingly more precise context of purely

instructional films and television programs there are few absolutes, as evidenced in this research rationale for the Educational Products Information Exchange by Robert E. Stake*:

> No product evaluation can be complete without a survey of the preferences and priorities of the many groups who use the product, or who may benefit or be injured by it.
>
> ...
>
> Every product can, of course, be described in a variety of ways, and comparisons among products can be made on many different grounds. Two dictionaries, for example, may differ as to number of words defined, size or type, durability of binding, and attractiveness of illustrations. They may differ, too, in less tangible matters, such as the thoroughness of definitions or the sanctity in which formal grammar is held. One dictionary is likely to be better for some purposes, another for other purposes. It will be the responsibility of the researcher to describe the dictionaries as fully as he can, then to indicate the conditions under which he knows or suspects that individual dictionaries will do a good job (and, sometimes, which dictionary will do a better job.)

We felt justified in going our own way to try to discover something about the "instructional utility" of these programs, and also to seek information about viewing habits and attitudes toward science on public television.

The role of public television in disseminating scientific information to the many audiences it serves is affirmed in the results analyzed in this investigation. Films such as these in the "Spectrum" series are documented reports of current research in basic and applied science. They utilize the techniques and expertise of, on the one hand, the scientists themselves, and on the other, the professionals of public television. The

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*Excerpts from A Research Rationale for EPIE, by Robert E. Stake, Educational Products Information Exchange; The EPIE Forum, Vol.1, No.1, Sept., 1968, pp. 7 & 8.

"mix" produced by this collaboration amounts to an unexcelled, highly communicative learning opportunity for millions of persons of greatly varying backgrounds and levels of sophistication. The word "opportunity" is central, for public television does not "teach" in the conventional sense. Rather, it provides opportunities for learning, blueprints for further involvement. Many viewers seek these consciously, but many more receive them subliminally. In some the effect may be sharp awareness, even genuine knowledge. In others it is more tentative, a sampling to which they may return later.

As viewing of public television increases, it is inevitable that the intellectual and aesthetic tone of the nation's communities is raised and the public helped in making wiser choices in crucial issues. Clearly, science embodies many such issues, and filmed reports such as these are fundamental to the existence of an informed and enlightened public. They thus perform a service of high priority, and one which may not be similarly available in any other medium of communication.

Appendix A

Mail Questionnaire

NET

NATIONAL EDUCATIONAL TELEVISION

10 COLUMBUS CIRCLE NEW YORK, NEW YORK 10019 (212) 262-4200

MEMO to: Science Faculty and Administrators

From: Educational Services, NET April 1969

Subject: Evaluation of five science programs

Searching for a mysterious source of energy in space; trying to turn a harmless cloud into a rain storm; discovering how to predict when disastrous earthquakes will occur; reading the "language" of genetics, and visiting a world-renowned scientist--these are experiences in store for viewers of five half-hour programs to be broadcast this spring over most of the NET network.

Produced with financial assistance from the National Science Foundation, the programs are, in the order of broadcast:

Exploring the Universe--in Radio and Light
Changing the Weather (Color)
The Trembling Earth (Color)
Stop or Go--an Experiment in Genetics (Color)
A Visit with Harold Urey

printed red

The network broadcast schedule for the five programs will be weekly, beginning at 8:00 p.m. Eastern Time on April 30, and ending on May 28. However, local ETV listings should be consulted in every case, as stations may delay (or repeat) programs in many areas of the country.

NET asks for your help in evaluating the effectiveness of these programs. We are especially interested in learning whether they can help bridge gaps in the lay public's understanding of science. Please help us by returning this form after viewing at least one of the five broadcasts. A return envelope, requiring no postage, is enclosed for your convenience.

red

You will also find enclosed one or more study guides of programs in your indicated field of specialization. Please use them as a means of acquainting yourself and your students with the program. In your evaluation, however, please bear in mind that the average home viewer will not usually have such a guide available.

NET attempts, in its continuing science programming, to present information in such a way that the lay public's appreciation of science is increased. Although we feel that these television programs can also enrich the science curriculum, the principal aim is to provide information to the viewer at home.

You can help significantly in this effort by taking a few minutes to give us your opinion of the approach we have taken, and any suggestions as to how it might be improved.

red

If you are able to view more than one of the five programs, and would be willing to give us your reaction to them, please feel free to use additional sheets. The use of your name and/or address is optional.

May we thank you in advance for your cooperation.

(please turn page)

To: Henry C. Alter, Director of Educational Services, NET

Subject: Evaluation of _____
Title of Program

1. Date of broadcast: _____

2. City in or near which broadcast was seen: _____

3. Is it possible that you might have viewed this program if you had not received this notice?

yes____ no____

4. Do you feel that this program presented information about science that the general public should have?

_____

5. Was the information presented so as to benefit a lay person?

Entirely_____ In Part_____ Not at All_____

_____

6. Please comment briefly as to strong points and/or weaknesses in the presentation:

7. In your opinion, could the broadcast have the effect of encouraging young people to seek careers in science?

_____

8. (OPTIONAL) Your name: _____

Address: _____

9. If you would like single copies of study guides not enclosed, please list here the titles you want (and complete your address.)

_____

_____